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(54) **DEVELOPMENT OF EXTENSIONAL VISCOSITY FOR REDUCED ATOMIZATION FOR DILUTED CONCENTRATE SPRAYER APPLICATIONS**

ENTWICKLUNG VON DEHNVISKOSITÄT ZUR REDUZIERTEN ZERSTÄUBUNG FÜR  
SPRÜHANWENDUNGEN MIT VERDÜNNTEM KONZENTRAT

MISE AU POINT DE LA VISCOSITÉ D'EXTENSION POUR UNE ATOMISATION RÉDUITE DES  
APPLICATIONS DE PULVÉRISATEUR CONCENTRÉ DILUÉ

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**Description**

## TECHNICAL FIELD

5 **[0001]** The present invention is related to a method of forming a sprayable use solution.

## BACKGROUND

10 **[0002]** Aqueous sprayable compositions can be applied to a hard surface with a transient trigger spray device or an aerosol spray device. These cleaners have great utility because they can be applied by spray to vertical, overhead or inclined surfaces. Spray devices create a spray pattern of the aqueous sprayable compositions that contacts the target hard surfaces. The majority of the sprayable composition comes to reside on the target hard surfaces as large sprayed-on deposits, while a small portion of the sprayable composition may become an airborne aerosol or mist, which consists of small particles comprising the cleaning composition that can remain suspended or dispersed in the atmosphere

15 **[0003]** The aqueous sprayable compositions may be supplied as concentrated solutions which may be diluted with water to form use solutions. Such concentrated solutions reduce transportation and storage costs since the dilution water is not transported or stored but instead is added to the solution at a later time. In some embodiments, it is preferable that the concentrate is stable at elevated temperatures and low temperatures, such as those experienced during transportation and storage.

20 **[0004]** WO2008/148420 A1 relates to a liquid detergent concentrate composition comprising an emulsion having an aqueous phase and an oil phase.

25 **[0005]** WO2007/101470 A1 relates to a liquid detergent concentrate composition comprising an emulsion having a water phase and an oil phase, the composition comprising 5 - 30 wt-% of one or more alkalinity source 1 - 70 wt-% of a at least one non-ionic surfactant 0.01 - 10 wt-% of one or more crosslinked or partly crosslinked polyacrylic acid or polymethacrylic acid.

## SUMMARY

30 **[0006]** The invention relates to a method of forming a sprayable use solution according to the appended claims.

**[0007]** The method comprises mixing water with a concentrate aqueous composition to create the use solution, the concentrate aqueous composition comprising: at least one surfactant; and a polyacrylate which reduces atomization and misting when the use solution is dispensed using a sprayer, wherein the concentrate aqueous composition is mixed with sufficient water to form a use solution having between 0.2% and 5% by weight polyacrylate.

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## BRIEF DESCRIPTION OF THE DRAWINGS

**[0008]**

40 FIG. 1 illustrates the percentage of droplets below 11 microns for stock ready to use sprayable solutions and ready to use sprayable solutions modified with polyethylene oxide when applied with a stock trigger sprayer (i.e., non-low viscosity sprayer).

FIG. 2 illustrates average droplet size for stock ready to use sprayable solutions and ready to use sprayable solutions modified with polyethylene oxide when applied with a stock trigger sprayer.

45 FIG. 3 illustrates average droplet size for stock ready to use sprayable solutions and ready to use sprayable solutions modified with polyethylene oxide when applied with a low viscosity trigger sprayer.

## DETAILED DESCRIPTION

50 **[0009]** When dispensed with a trigger sprayer, the sprayable use solution has a median droplet size above 50 microns. It has been found that increasing the droplet size of the dispensed use solution can reduce inhalation and aerosol and misting.

**[0010]** The sprayable compositions can be used in any environment where it is desirable to have larger droplet sizes dispensed from a transient trigger sprayer. For example, the sprayable composition can be used in institutional applications, food and beverage applications, health care applications, vehicle care applications, pest elimination applications, and laundering applications. Such applications include but are not limited to laundry and textile cleaning and destaining, kitchen and bathroom cleaning and destaining, carpet cleaning and destaining, vehicle cleaning and destaining, cleaning in place operations, general purpose cleaning and destaining, surface cleaning and destaining, particularly hard surfaces,

glass window cleaning, air freshening or fragrancing, industrial or household cleaners, antimicrobial cleaning.

**[0011]** The concentrate sprayable composition includes at least one anti-mist component, which is polyacrylate. The anti-mist component may function to reduce atomization and misting of the sprayable solution when dispensed using a sprayer, including aerosol sprayers and transient trigger sprayers. Example transient trigger sprayers include stock transient trigger sprayers (i.e., non-low velocity trigger sprayer) and low-velocity trigger sprayers, both available from Calmar. Suitable commercially available stock transient trigger sprayers include Calmar Mixor HP 1.66 output trigger sprayer. The anti-mist component may also increase the median particle size of the dispensed use solution, which reduces inhalation of the use solution, and particularly reduces inhalation of the sensitizer or irritant.

**[0012]** In one example, the concentrate sprayable composition includes mixtures of polyethylene oxide (PEO), polyacrylamide and polyacrylate. A suitable PEO can have a molecular weight between 3,000,000 and 7,000,000. One commercially available PEO is Polyox WSR 301, which has a molecular weight of 4,000,000 and is available from Dow. A suitable concentration range for PEO is between approximately 0.01% and 0.3% by weight of the concentrate sprayable solution. A particularly suitable concentration range for PEO is between approximately 0.01% and 0.2% by weight of the concentrate sprayable solution.

**[0013]** The anti-mist component may additionally include a polyacrylamide. A suitable polyacrylamide can have a molecular weight between 8 million and 16 million, and more suitably between 11 million and 13 million. One commercially available polyacrylamide is SuperFloc® N-300 available from Kemira Water Solutions, Inc. A suitable concentration range for polyacrylamide is between approximately 0.01% and 0.3% by weight of the concentrate sprayable solution. A particularly suitable concentration range for polyacrylamide is between approximately 0.01% and 0.2% by weight of the concentrate sprayable solution.

**[0014]** Polyacrylate is a high molecular weight polymer. A suitable polyacrylate polymer can have a molecular weight between 500,000 and 3 million. A more suitable polyacrylate polymer can have a molecular weight of at least 1 million. One commercially available polyacrylate is Aquatreat® AR-7H available from Akzo Nobel. Suitable polyacrylate concentrations in the concentrate composition are between 0.5% and 20% by weight. Particularly suitable polyacrylate concentrations in the concentrate composition are between 1% and 10% by weight.

**[0015]** The concentrate sprayable compositions may optionally include at least one stability component. The effectiveness of an anti-mist component to reduce misting and increase droplet size may degrade over time. A stability component may reduce degradation of the anti-mist component and improve the self-life of the concentrate sprayable composition. Suitable stability components may include antioxidants, chelants, and solvents. Example antioxidants include, but are not limited to, Irganox® 5057, a liquid aromatic amine antioxidant, Irganox® 1135, a liquid hindered phenolic antioxidant, Tinogard NOA, and Irgafos 168, all available from BASF. Additional example antioxidants include vitamin E acetate. Example chelants include, but are not limited to: sodium gluconate, sodium glucoheptonate, N-hydroxyethylenediaminetetraacetic acid (HEDTA), ethylenediaminetetraacetic acid (EDTA), nitrilotriacetic acid (NTA), diethylenetriaminepentaacetic acid (DTPA), ethylenediaminetetrapropionic acid, triethylenetetraaminehexaacetic acid (TTHA), and the respective alkali metal, ammonium and substituted ammonium salts thereof, ethylenediaminetetraacetic acid tetrasodium salt (EDTA), nitrilotriacetic acid trisodium salt (NTA), ethanoldiglycine disodium salt (EDG), diethanolglycine sodium-salt (DEG), and 1,3-propylenediaminetetraacetic acid (PDTA), dicarboxymethyl glutamic acid tetrasodium salt (GLDA), methylglycine-N-N-diacetic acid trisodium salt (MGDA), and iminodisuccinate sodium salt (IDS). Suitable commercially available chelant include Dissolvine® GL-47-S, tetrasodium glutamate diacetate, and Dissolvine® GL-38, glutamic acid, N,N-diacetic acid, tetra sodium salt, both available from Akzo Nobel. Example solvents include, but are not limited to, propylene glycol and glycerine. A suitable concentration range of the stability components includes between approximately 100 parts per million (ppm) and approximately 100,000 ppm of the concentrate sprayable composition or between approximately 0.01% and 10% by weight. A particularly suitable concentration range of the stability components includes between approximately 100 parts per million (ppm) and approximately 70,000 ppm of the concentrate sprayable composition or between approximately 0.01% and 7% by weight.

**[0016]** The concentrate sprayable compositions may include a combination of stability components, which may further improve the stability of the composition. For example, the concentrate sprayable compositions may include a combination of two or more antioxidants, chelants and solvents. In one example, the concentrate sprayable composition may include an antioxidant and a chelant. In a further example the concentrate sprayable composition may include Irganox® 1135 and Dissolvine® GL-47-S. It has been found that when used in combination the effective amounts of Irganox® 1135 and Dissolvine® GL-47-S are half the effective amounts of each when used alone.

**[0017]** The concentrate sprayable composition is a non-Newtonian fluid. Newtonian fluids have a short relaxation time and have a direct correlation between shear and elongational viscosity (the elongational viscosity of the fluid equals three times the shear viscosity). Shear viscosity is a measure of a fluid's ability to resist the movement of layers relative to each other. Elongational viscosity, which is also known as extensional viscosity, is measure of a fluid's ability to stretch elastically under elongational stress. Non-Newtonian fluids do not have a direct correlation between shear and elongational viscosity and are able to store elastic energy when under strain, giving exponentially more elongational than shear viscosity and producing an effect of thickening under strain (i.e., shear thickening). These properties of non-Newtonian

fluids result in the sprayable composition that has a low viscosity when not under shear but that thickens when under stress from the trigger sprayer forming larger droplets.

**[0018]** The concentrate sprayable composition has a relatively low shear viscosity when not under strain. The shear viscosity can be measured with a Brookfield LVDV-II viscometer using spindle R1, at 50 rpm and room temperature. As described further below, in one example, the shear viscosity of the concentrate sprayable composition is comparable to the shear viscosity of water. A suitable shear viscosity for the concentrate sprayable composition is 40 centipoises or less. A more preferable shear viscosity is 30 centipoises or less. In one example, the anti-mist components do not increase the shear viscosity of the concentrate sprayable composition when not under strain and the increased shear viscosity is created by other components, such as the surfactant. In comparison to the low shear viscosity concentrate sprayable composition of the current application, adding xanthan gum to a concentrate produces a Newtonian fluid which is too thick to be used as a concentrate. The concentrate sprayable composition of the current application forms a low shear viscosity, water thin, mixture even at high concentrations of the anti-mist component, such as those required for concentrate solutions.

**[0019]** In another example, a flowable concentrate sprayable composition contains a sufficient amount of anti-mist component such that the median particle size of the dispensed use solution is sufficiently large enough to reduce misting. A suitable median particle size is 11 microns or greater. A particularly suitable median particle size is 50 microns or greater. A more particularly suitable median particle size is 70 microns or greater, 100 microns or greater, 150 microns or greater, or 200 microns or greater. The suitable median particle size may depend on the composition of the use solution, and thus of the concentrate sprayable composition. For example, a suitable median particle size for a strongly acidic or alkaline use solution may be 100 microns or greater, and more particularly 150 microns or greater, and more particularly 200 microns or greater. A suitable median particle size for a moderately acidic or alkaline use solution may be 11 microns or greater, preferably 50 microns or greater, and more preferably 150 microns or greater. A strongly acid use solution may have a pH of 3 or below, a strongly alkaline use solution may have a pH of 11 or greater, and a moderately acidic or alkaline use solution may have a pH between 3 and 11.

**[0020]** In another example, the concentrate sprayable compositions generally include at least one acid, at least one surfactant, and polyacrylate. A suitable concentration range of the components of the concentrate sprayable composition includes between approximately 0.1% and 30% by weight surfactant, between approximately 7% and 75% by weight of at least one acid, and between approximately 0.5% and 20% polyacrylate. The concentrate sprayable compositions can be diluted with water to form ready to use solutions.

**[0021]** The acid can be a strong acid which substantially dissociates in an aqueous solution such as, but not limited to hydrobromic acid, hydroiodic acid, hydrochloric acid, perchloric acid, sulfuric acid, trichloroacetic acid, trifluoroacetic acid, nitric acid, dilute sulfonic acid, and methanesulfonic acid. Weak organic or inorganic acids can also be used. Weak acids are acids in which the first dissociation step of a proton from the acid cation moiety does not proceed essentially to completion when the acid is dissolved in water at ambient temperatures at a concentration within the range useful to form the present sprayable composition. Such inorganic acids are also referred to as weak electrolytes. Examples of weak organic and inorganic acids include phosphoric acid, sulfamic acid, acetic acid, hydroxy acetic acid, citric acid, benzoic acid, tartaric acid, maleic acid, malic acid, fumaric acid, lactic acid, succinic acid, gluconic acid, glucaric acid. Mixtures of strong acid with weak acid or mixtures of a weak organic acid and a weak inorganic acid with a strong acid may also be used.

**[0022]** The acid can be present in sufficient quantities such that the concentrate sprayable composition has an acidic pH. In one example, the concentrate sprayable composition has a pH of 4.5 or lower. In another example, the concentrate sprayable composition includes between approximately 7% and 75% by weight acid. In a further example, the concentrate sprayable composition includes between approximately 10% and approximately 65% by weight acid. In a still further example, the concentrate sprayable composition includes between approximately 40% and 60% by weight acid. Highly acidic concentrate sprayable compositions, particularly those including between approximately 40% and 60% by weight acid, containing at least one anti-mist component have demonstrated instability when stored at elevated temperatures for extended periods of time. The stability component may improve the shelf-life of the concentrate sprayable compositions.

**[0023]** The acid can also include a fatty acid, such as a fatty acid antimicrobial agent or neutralized salt of a fatty acid. Suitable fatty acids include medium chain fatty acids, including C<sub>6</sub>-C<sub>16</sub> alkyl carboxylic acids, such as hexanoic acid, butyric acid, octanoic acid, heptanoic acid, nonanoic acid, decanoic acid, undecanoic acid, and dodecanoic acid. More suitable fatty acids include a C<sub>8</sub>-C<sub>12</sub> alkyl carboxylic acid, still more suitably C<sub>9</sub>-C<sub>10</sub> alkyl carboxylic acid, such as decanoic acid (capric acid). In one example, the sprayable composition includes at least one fatty acid and has a total acid concentration of between 7% and 45% by weight. In a further example, the fatty acid comprises between 1% and 10% by weight with a total acid concentration between 7% and 45% by weight.

**[0024]** The concentrate sprayable composition includes a surfactant. A variety of surfactants may be used, including anionic, nonionic, cationic, and amphoteric surfactants. Example suitable anionic materials are surfactants containing a large lipophilic moiety and a strong anionic group. Such anionic surfactants contain typically anionic groups selected

from the group consisting of sulfonic, sulfuric or phosphoric, phosphonic or carboxylic acid groups which when neutralized will yield sulfonate, sulfate, phosphonate, or carboxylate with a cation thereof preferably being selected from the group consisting of an alkali metal, ammonium, alkanol amine such as sodium, ammonium or triethanol amine. Examples of operative anionic sulfonate or sulfate surfactants include alkylbenzene sulfonates, sodium xylene sulfonates, sodium dodecylbenzene sulfonates, sodium linear tridecylbenzene sulfonates, potassium octyldecylbenzene sulfonates, sodium lauryl sulfate, sodium palmityl sulfate, sodium cocoalkyl sulfate, sodium olefin sulfonate.

**[0025]** Nonionic surfactants carry no discrete charge when dissolved in aqueous media. Hydrophilicity of the nonionic is provided by hydrogen bonding with water molecules. Such nonionic surfactants typically comprise molecules containing large segments of a polyoxyethylene group in conjunction with a hydrophobic moiety or a compound comprising a polyoxypropylene and polyoxyethylene segment. Polyoxyethylene surfactants are commonly manufactured through base catalyzed ethoxylation of aliphatic alcohols, alkyl phenols and fatty acids. Polyoxyethylene block copolymers typically comprise molecules having large segments of ethylene oxide coupled with large segments of propylene oxide. These nonionic surfactants are well known for use in this art area. Additional example nonionic surfactants include alkyl polyglycosides.

**[0026]** The lipophilic moieties and cationic groups comprising amino or quaternary nitrogen groups can also provide surfactant properties to molecules. As the name implies to cationic surfactants, the hydrophilic moiety of the nitrogen bears a positive charge when dissolved in aqueous media. The soluble surfactant molecule can have its solubility or other surfactant properties enhanced using low molecular weight alkyl groups or hydroxy alkyl groups.

**[0027]** The composition can contain a cationic surfactant component that includes a detergic amount of cationic surfactant or a mixture of cationic surfactants. The cationic surfactant can be used to provide sanitizing properties. In one example, cationic surfactants can be used in either acidic or basic compositions.

**[0028]** Cationic surfactants that can be used in the composition include, but are not limited to: amines such as primary, secondary and tertiary monoamines with C<sub>18</sub> alkyl or alkenyl chains, ethoxylated alkylamines, alkoxylates of ethylenediamine, imidazoles such as a 1-(2-hydroxyethyl)-2-imidazoline, a 2-alkyl-1-(2-hydroxyethyl)-2-imidazoline; and quaternary ammonium compounds and salts, as for example, alkylquaternary ammonium chloride surfactants such as n-alkyl(C<sub>12</sub>-C<sub>18</sub>)dimethylbenzyl ammonium chloride, n-tetradecyldimethylbenzyl ammonium chloride monohydrate, a naphthylene-substituted quaternary ammonium chloride such as dimethyl-1-naphthylmethylammonium chloride.

**[0029]** Amphoteric surfactants can also be used. Amphoteric surfactants contain both an acidic and a basic hydrophilic moiety in the structure. These ionic functions may be any of the anionic or cationic groups that have just been described previously in the sections relating to anionic or cationic surfactants. Briefly, anionic groups include carboxylate, sulfate, sulfonate, phosphonate, etc. while the cationic groups typically comprise compounds having amine nitrogens. Many amphoteric surfactants also contain ether oxides or hydroxyl groups that strengthen their hydrophilic tendency. Preferred amphoteric surfactants of this invention comprise surfactants that have a cationic amino group combined with an anionic carboxylate or sulfonate group. Examples of useful amphoteric surfactants include the sulfobetaines, N-coco-3,3-aminopropionic acid and its sodium salt, n-tallow-3-amino-dipropionate disodium salt, 1,1-bis(carboxymethyl)-2-undecyl-2-imidazolium hydroxide disodium salt, cocoaminobutyric acid, cocoaminopropionic acid, cocoamidocarboxy glycinate, cocobetaine. Suitable amphoteric surfactants include cocoamidopropylbetaine and cocoaminoethylbetaine.

**[0030]** Amine oxides, such as tertiary amine oxides, may also be used as surfactants. Tertiary amine oxide surfactants typically comprise three alkyl groups attached to an amine oxide (N→O). Commonly the alkyl groups comprise two lower (C<sub>1-4</sub>) alkyl groups combined with one higher C<sub>6-24</sub> alkyl groups, or can comprise two higher alkyl groups combined with one lower alkyl group. Further, the lower alkyl groups can comprise alkyl groups substituted with hydrophilic moiety such as hydroxyl, amine groups, carboxylic groups, etc. Suitable amine oxide materials include dimethylcetylamine oxide, dimethylaurylamine oxide, dimethylmyristylamine oxide, dimethylstearylamine oxide, dimethylcocoamine oxide, dimethyldecylamine oxide, and mixtures thereof. The classification of amine oxide materials may depend on the pH of the solution. On the acid side, amine oxide materials protonate and can simulate cationic surfactant characteristics. At neutral pH, amine oxide materials are non-ionic surfactants and on the alkaline side, they exhibit anionic characteristics.

**[0031]** The concentrate acidic sprayable compositions may include water. Suitable concentrations of water include between 25% and 90% by weight. More suitable concentrations of water include between 45% and 70% by weight and between 25% and 45% by weight.

**[0032]** When the concentrate quaternary sprayable composition includes polyacrylate, suitable concentrations include between 75% and 95% by weight water, between 5% and 30% by weight quaternary compounds, less than 1% of at least one fragrance or dye, between 0.5% and 20% by weight of polyacrylate and optionally between 0.01% and 10% by weight of a stability component. In a further example, the concentrate quaternary sprayable composition consists essentially of between 75% and 95% by weight water, between 5% and 30% by weight quaternary compounds, less than 1% of at least one fragrance dye, between 0.5% and 20% by weight of polyacrylate and optionally between 0.01% and 10% by weight of a stability component.

**[0033]** In a further embodiment, the concentrate sprayable composition is a concentrate sprayable air freshener composition. Suitable concentrations when the anti-mist component is polyacrylate include between 50% and 90% by weight

water, between 1% and 15% by weight nonionic surfactant, between 1% and 10% by weight anionic surfactant, between 0.5% and 20% by weight polyacrylate, between 0.05% and 15% by weight of at least one fragrance or dye, and optionally may include between 0.01% and 10% by weight of at least one stability component. The concentrate sprayable air freshener composition may include between 0% and 0.1% by weight of a microbiocide, and more preferably may include between 0.03% and 0.1% by weight of microbiocide. In a further example, the sprayable compositions consist essentially of the components listed above.

**[0034]** In a still further embodiment, the sprayable composition is a concentrate sprayable window glass cleaning composition.

**[0035]** Suitable surfactants include alkyl polyglycosides. Suitable alkyl polyglycosides include but are not limited to alkyl polyglucosides and alkyl polypentosides. Alkyl polyglycosides are bio-based non-ionic surfactants which have wetting and deterative properties. Commercially available alkyl polyglycosides may contain a blend of carbon lengths. Suitable alkyl polyglycosides include alkyl polyglycosides containing short chain carbons, such as chain lengths of less than C<sub>12</sub>. In one example, suitable alkyl polyglycosides include C<sub>8</sub>-C<sub>10</sub> alkyl polyglycosides and alkyl polyglycosides blends primarily containing C<sub>8</sub>-C<sub>10</sub> alkyl polyglycosides. Suitable commercially available alkyl polyglucosides include Glucopon 215 UP available from BASF Corporation. Alkyl polypentosides are commercially available from Wheatoleo. Suitable commercially available polypentosides include Radia®Easysurf 6781, which contains chain lengths of C<sub>8</sub>-C<sub>10</sub> and is available from Wheatoleo.

**[0036]** Suitable solvents include propylene glycol and suitable bio-based alternatives 1,3-propanediol. Alternatively, glycerine may be used when a low VOC, high bio-based content cleaner is desired. Glycerine is a poor solvent. However, it has been found that glycerine can help a cloth "glide" across the surface of a window and reduce streaking.

**[0037]** The concentrate window glass cleaning composition can optionally include a sheeting agent, such as an ethylene oxide and propylene oxide block copolymer. Suitable sheeting agents include Pluronic N-3, available from BASF Corporation. In some situations, it may be desirable to exclude ethylene oxide and propylene oxide block copolymers from the concentrate window glass cleaning composition.

**[0038]** A dispersant may be added to the concentrate sprayable window glass cleaning composition to assist with dispersing water hardness and other non-hardness materials such as but not limited to total dissolved solids such as sodium salts. Suitable dispersants include sodium polycarboxylates, such as sodium polyacrylate, and acrylate/sulfonated co-polymers. In one example, the sodium polycarboxylate or acrylate/sulfonated co-polymer has a molecular weight less than 100,000. In another example, the sodium polycarboxylate or acrylate/sulfonated co-polymer has a molecular weight less than 50,000. In a further example, the sodium polycarboxylate or acrylate/sulfonated co-polymer has a molecular weight between 5,000 and 25,000. Suitable commercially available polymers include Acusol 460N available from Rohm and Haas and Aquatreat AR-546 available from Akzo Nobel.

**[0039]** Suitable chelants include amino-carboxylates such as but not limited to salts of ethylenediamine-tetraacetic acid (EDTA) and methyl glycine di-acetic acid (MGDA), and dicarboxymethyl glutamic acid tetrasodium salt (GLDA). The amino-carboxylates may also be in its acid form. Suitable commercially available MGDA's include but are not limited to Trilon® M available from BASF. Biobased amino-carboxylates, such as GLDA, may also be used. Suitable biobased amino-carboxylates may contain at least 40% bio-based content, at least 45% bio-based content, and more preferably, at least 50% bio-based content. For example, suitable commercially available GLDA's include but are not limited to Dissolvine® GL-47-S and Dissolvine® GL-38 both available from Akzo Nobel, which contain approximately 50% bio-based content.

**[0040]** A suitable VOC content of the use solution includes less than 3% VOCs by weight of the use solution, less than 1% VOCs by weight of the use solution, or 0% VOCs by weight of the use solution. The low VOC concentrate window glass cleaning composition may also have a relatively high biobased content. In one example, the low VOC concentrate window glass cleaning composition includes at least 49% biobased content. More suitably, the low VOC concentrate window glass cleaning composition includes at least 75%, at least 80%, at least 85%, at least 90%, or at least 95% biobased content. Suitable low VOC window glass cleaning compositions are also disclosed in the provisional application entitled "Bio-Based Glass Cleaner" (Attorney Docket No. 401367) which was filed on even date.

**[0041]** It is recognized that the above components may be replaced partially or in total with a comparable biobased component. Biobased components are components that are composed, in whole or in significant part, of biological products. The amount of biological components or derivatives is referred to as biobased content, which is the amount of biobased carbon in the material or product expressed as a percent of weight (mass) of the total organic carbon in the material or product. Biobased content can be determined using ASTM Method D6866, entitled Standard Test Methods for Determining the Biobased Content of Natural Range Materials Using Radiocarbon and Isotope Ratio Mass Spectrometry Analysis. More specifically, ASTM Method D6866 uses radiocarbon dating to measure the amount of new carbon present in a product as a percentage of the total organic carbon by comparing the ratio of Carbon 12 to Carbon 14. The water content of a product is not included as part of biobased content as it contains no carbon. It is noted that biobased content is distinct from product biodegradability. Product biodegradability measures the ability of microorganisms present in the disposal environment to completely consume the carbon components within a product within a reasonable amount

of time and in a specified environment. In one example, the concentrate cleaning composition includes at least 49% biobased content. More suitably, the concentrate composition includes at least 75%, at least 80%, at least 85%, at least 90%, or at least 95% biobased content.

## 5 Additional Functional Materials

**[0042]** The concentrate sprayable composition may contain other functional materials that provide desired properties and functionalities to the sprayable composition. For the purposes of this application, the term "functional materials" includes a material that when dispersed or dissolved in a use solution/concentrate solution, such as an aqueous solution, provides a beneficial property in a particular use. Examples of functional materials include but are not limited to: aqueous compatible solvents, sequestrants, metal protectors, dyes/odorants, preservatives, and microbiocides.

### Aqueous Compatible Solvents

**[0043]** The concentrate sprayable composition can contain a compatible solvent. Suitable solvents are soluble in the aqueous sprayable composition of the invention at use proportions. Preferred soluble solvents include lower alkanols, lower alkyl ethers, and lower alkyl glycol ethers. These materials are colorless liquids with mild pleasant odors, are excellent solvents and coupling agents and are typically miscible with aqueous sprayable compositions of the invention. Examples of such useful solvents include methanol, ethanol, propanol, isopropanol and butanol, isobutanol, ethylene glycol, diethylene glycol, triethylene glycol, propylene glycol, dipropylene glycol, mixed ethylene-propylene glycol ethers. The glycol ethers include lower alkyl (C<sub>1</sub>-8 alkyl) ethers including propylene glycol methyl ether, propylene glycol ethyl ether, propylene glycol propyl ether, dipropylene glycol methyl ether, dipropylene glycol ethyl ether, tripropylene glycol methyl ether, ethylene glycol methyl ether, ethylene glycol ethyl ether, ethylene glycol butyl ether, diethylene glycol methyl ether, diethylene glycol butyl ether, ethylene glycol dimethyl ether, ethylene glycol monobutyl ether, and others. The solvent capacity of the cleaners can be augmented by using monoalkanol amines.

### Sequestrants

**[0044]** The concentrate sprayable composition can contain an organic or inorganic sequesterant or mixtures of sequestrants. Organic sequestrants such as citric acid, the alkali metal salts of nitrilotriacetic acid (NTA), EDTA, alkali metal gluconates, polyelectrolytes such as a polyacrylic acid, sodium gluconate can be used herein.

**[0045]** The concentrate sprayable composition can also comprise an effective amount of a water-soluble organic phosphonic acid which has sequestering properties. Preferred phosphonic acids include low molecular weight compounds containing at least two anion-forming groups, at least one of which is a phosphonic acid group. Such useful phosphonic acids include mono-, di-, tri- and tetra-phosphonic acids which can also contain groups capable of forming anions under alkaline conditions such as carboxy, hydroxy, thio and the like. Among these are phosphonic acids having the formulae: R<sub>1</sub>N[CH<sub>2</sub>PO<sub>3</sub>H<sub>2</sub>]<sub>2</sub> or R<sub>2</sub>C(PO<sub>3</sub>H<sub>2</sub>)<sub>2</sub> OH, wherein R<sub>1</sub> may be -[(lower)alkylene]N[CH<sub>2</sub>PO<sub>3</sub>H<sub>2</sub>]<sub>2</sub> or a third-CH<sub>2</sub>PO<sub>3</sub>H<sub>2</sub> moiety; and wherein R<sub>2</sub> is selected from the group consisting of C<sub>1</sub>C<sub>6</sub> alkyl.

**[0046]** The phosphonic acid may also comprise a low molecular weight phosphonopolycarboxylic acid such as one having 2-4 carboxylic acid moieties and 1-3 phosphonic acid groups. Such acids include 1-phosphono-1-methylsuccinic acid, phosphonosuccinic acid and 2-phosphonobutane-1,2,4-tricarboxylic acid.

**[0047]** Other organic phosphonic acids include 1-hydroxyethylidene-1,1-diphosphonic acid (CH<sub>3</sub>C(PO<sub>3</sub>H<sub>2</sub>)<sub>2</sub>OH), available from ThermPhos as Dequest® 2010, a 58-62% aqueous solution; amino [tri(methylenephosphonic acid)] (N[CH<sub>2</sub>PO<sub>3</sub>H<sub>2</sub>]<sub>3</sub>), available from ThermPhos as Dequest® 2000, a 50% aqueous solution; ethylenediamine [tetra(methylenephosphonic acid)] available from ThermPhos as Dequest® 2041, a 90% solid acid product; and 2-phosphonobutane-1,2,4-tricarboxylic acid available from Lanxess as Bayhibit AM, a 45-50% aqueous solution. It will be appreciated that, the above-mentioned phosphonic acids can also be used in the form of water-soluble acid salts, particularly the alkali metal salts, such as sodium or potassium; the ammonium salts or the alkylol amine salts where the alkylol has 2 to 3 carbon atoms, such as mono-, di-, or tri- ethanolamine salts. If desired, mixtures of the individual phosphonic acids or their acid salts can also be used. Further useful phosphonic acids are disclosed in U.S. Pat. No. 4,051,058.

**[0048]** The sprayable composition can also incorporate a water soluble acrylic polymer which can act to condition the wash solutions under end-use conditions. Such polymers include polyacrylic acid, polymethacrylic acid, acrylic acid-methacrylic acid copolymers, hydrolyzed polyacrylamide, hydrolyzed polymethacrylamide, hydrolyzed acrylamide-methacrylamide copolymers, hydrolyzed polyacrylonitrile, hydrolyzed polymethacrylonitrile, hydrolyzed acrylonitrile-methacrylonitrile copolymers, or mixtures thereof. Water-soluble salts or partial salts of these polymers such as the respective alkali metal (e.g. sodium or potassium) or ammonium salts can also be used. The weight average molecular weight of the polymers is from 500 to 15,000 and is preferably within the range of from 750 to 10,000. Preferred polymers include polyacrylic acid, the partial sodium salt of polyacrylic acid or sodium polyacrylate having weight average molecular

weights within the range of 1,000 to 6,000. These polymers are commercially available, and methods for their preparation are well-known in the art.

[0049] For example, commercially-available water-conditioning polyacrylate solutions useful in the present sprayable solutions include the sodium polyacrylate solution, Colloid® 207 (Colloids, Inc., Newark, N.J.); the polyacrylic acid solution, Aquatreat®AR-602-A (Alco Chemical Corp., Chattanooga, Tenn.); the polyacrylic acid solutions (50-65% solids) and the sodium polyacrylate powders (m.w. 2,100 and 6,000) and solutions (45% solids) available as the Goodrite®K-700 series from B. F. Goodrich Co.; and the sodium- or partial sodium salts of polyacrylic acid solutions (m.w. 1000-4500) available as the Acrysol® series from Rohm and Haas.

[0050] The present sprayable composition can also incorporate sequestrants to include materials such as, complex phosphate sequestrants, including sodium tripolyphosphate, sodium hexametaphosphate, as well as mixtures thereof. Phosphates, the sodium condensed phosphate hardness sequestering agent component functions as a water softener, a cleaner, and a detergent builder. Alkali metal (M) linear and cyclic condensed phosphates commonly have a  $M_2O:P_2O_5$  mole ratio of 1:1 to 2:1 and greater. Typical polyphosphates of this kind are the preferred sodium tripolyphosphate, sodium hexametaphosphate, sodium metaphosphate as well as corresponding potassium salts of these phosphates and mixtures thereof. The particle size of the phosphate is not critical, and any finely divided or granular commercially available product can be employed.

[0051] Sodium tripolyphosphate is another inorganic hardness sequestering agent. Sodium tripolyphosphate acts to sequester calcium and/or magnesium cations, providing water softening properties. It contributes to the removal of soil from hard surfaces and keeps soil in suspension. It has little corrosive action on common surface materials and is low in cost compared to other water conditioners. Sodium tripolyphosphate has relatively low solubility in water (14 wt%) and its concentration must be increased using means other than solubility. Typical examples of such phosphates being alkaline condensed phosphates (i.e., polyphosphates) such as sodium or potassium pyrophosphate, sodium or potassium tripolyphosphate, sodium or potassium hexametaphosphate, etc.

#### Metal Protectors

[0052] The sprayable composition can contain a material that can protect metal from corrosion. Such metal protectors include for example sodium gluconate and sodium glucoheptonate.

#### Dyes/Odorants

[0053] Various dyes, odorants including perfumes, and other aesthetic enhancing agents may also be included in the compositions. Examples of suitable commercially available dyes include, but are not limited to: Direct Blue 86, available from Mac Dye-Chem Industries, Ahmedabad, India; Fastusol Blue, available from Mobay Chemical Corporation, Pittsburgh, PA; Acid Orange 7, available from American Cyanamid Company, Wayne, NJ; Basic Violet 10 and Sandolan Blue/Acid Blue 182, available from Sandoz, Princeton, NJ; Acid Yellow 23, available from Chemos GmbH, Regenstauf, Germany; Acid Yellow 17, available from Sigma Chemical, St. Louis, MO; Sap Green and Metanil Yellow, available from Keystone Aniline and Chemical, Chicago, IL; Acid Blue 9, available from Emerald Hilton Davis, LLC, Cincinnati, OH; Hisol Fast Red and Fluorescein, available from Capitol Color and Chemical Company, Newark, NJ; and Acid Green 25, Ciba Specialty Chemicals Corporation, Greenboro, NC.

[0054] Examples of suitable fragrances or perfumes include, but are not limited to: terpenoids such as citronellol, aldehydes such as amyl cinnamaldehyde, a jasmine such as CIS-jasmine or jasmal, and vanillin.

#### Surface Chemistry Modifiers

[0055] Various surface chemistry modifiers can be incorporated into the concentrate sprayable composition. Examples of suitable commercially available surface chemistry modifiers include Laponite® silicates available from Southern Clay Products, Inc. The surface chemistry modifiers may have high surface free energy and high surface area which leads to interactions with many types of organic compounds. In one example, suitable surface chemistry modifiers have a surface free energy of 200 mJoules/meter<sup>2</sup> and a surface area of between 750 and 800 m<sup>2</sup>/gram. A suitable concentration range for surface chemistry modifiers in the use solution is between 10 ppm and 100 ppm.

#### Use Solution

[0056] The concentrate sprayable composition is diluted with water, known as dilution water, to form a use solution. In general, a concentrate refers to a composition that is intended to be diluted with water to provide a use solution; a use solution is dispersed or used without further dilution.

[0057] The resulting use solution has a relatively low anti-mist component concentration. The polyacrylate concentra-

tion is between 0.2% and 5.0% by weight. In a further example, the polyacrylate concentration is between 0.3% and 3.0% by weight.

**[0058]** The resulting use solution can also have a relative low stability component concentration. In one suitable use solution, the stability component concentration is between 0.003% and 10% by weight.

**[0059]** As discussed above, the concentrate sprayable composition may include an acid. The acid may be present in a sufficient amount such that the solution has a pH of 4.5 or lower. In one example, a suitable acid concentration in the use solution is between 0.1% and 10% by weight of the use solution. The amount of acid present in the use solution may depend on whether the acid is a strong acid or a weak acid. Strong acids may have a greater tendency to lose protons such that a lower amount of strong acid is necessary to achieve the same pH compared to a weak acid. In one example, the use solution contains between 0.1% to 1% strong acid. In another example, the use solution contains between 1% and 10% weak acid.

**[0060]** The use solution can be dispensed using an aerosol sprayer or transient stock trigger sprayer (i.e., non-low velocity trigger), which results in limited drifting, misting, and/or atomization of the aqueous use solution. Example transient stock trigger sprayers include but are not limited to Calmar Mixor HP 1.66 output trigger sprayer. Reduction in drift, misting, and atomization can be determined from the droplet size of the applied solution, with an increased droplet size indicating reduced misting and atomization. The increased droplet size also reduces inhalation of the use solution. Preferably, the median droplet size is 10 microns or greater, 50 microns or greater, 70 microns or greater, 100 microns or greater, 150 microns or greater and preferably 200 microns or greater. There are several methods for determining droplet size including, but not limited to, adaptive high speed cameras, laser diffraction, and phase Doppler particle analysis. Commercially available laser diffraction apparatuses include Spraytec available from Malvern and Helos available from Sympatec.

**[0061]** When the use solution containing the anti-mist component is dispersed with a transient trigger sprayer, the resulting droplet size is increased compared to the same sprayable solutions not containing the anti-mist component. A suitable use solution containing the anti-mist component and sprayed with a stock sprayer results in less than 0.5% droplets having a droplet size below 11 microns, and more particularly less than 0.4% droplets having a droplet size below 11 microns, and more particularly less than 0.1% droplets having a droplet size below 11 microns.

**[0062]** The use solution may also be dispensed using a low velocity trigger sprayer, such as those available from Calmar. A typical transient trigger sprayer includes a discharge valve at the nozzle end of the discharge end of a discharge passage. A resilient member, such as a spring, keeps the discharge valve seated in a closed position. When the fluid pressure in the discharge valve is greater than the force of the resilient member, the discharge valve opens and disperses the fluid. A typical discharge valve on a stock trigger sprayer is a throttling valve which allows the user to control the actuation rate of the trigger sprayer. The actuation rate of the discharge valve determines the flow velocity, and a greater velocity results in smaller droplets. A low velocity trigger sprayer can contain a two-stage pressure build-up discharge valve assembly which regulates the operator's pumping stroke velocity and produces a well-defined particle size. In one example, the two-stage pressure build-up discharge valve can include a first valve having a high pressure threshold and a second valve having a lower pressure threshold so that the discharge valve snaps open and closed at the beginning and end of the pumping process. Example low-velocity trigger sprayers are commercially available from Calmar and are described in U.S. Pat. No. 5,522,547 to Dobbs and U.S. Pat. No. 7,775,405 to Sweeton. The low velocity trigger sprayers may result in less drifting, misting and atomization of the use solution, and may reduce the amount of small droplets dispensed. The sprayable composition containing an antimist component may work in synergy with the low velocity trigger sprayer to produce a greater increase in droplet size than expect based on the components alone. In one example, a use solution containing the anti-mist component sprayed with a low velocity trigger sprayer resulted in 0% droplets having a droplet size below 11 microns.

**[0063]** The use solution is a non-Newtonian liquid. When not under stress, the use solution has a viscosity similar to water. For example, in one embodiment, the use solution has a viscosity less than 40 centipoise.

**[0064]** As discussed above, the anti-mist component may increase the droplet size of the use solution when dispensed. The anti-mist component may also increase the average flight distance of the use solution when dispensed from a trigger sprayer. Increasing the average flight distance allows a user to be further away from the target hard surface and may decrease the likelihood of inhaling particulates, particularly particulates that rebound off of the hard surface.

## Embodiments

**[0065]** The concentrate sprayable composition is diluted with dilution water to form a use solution, which can be applied to a surface to remove soil using a sprayer device.

**[0066]** Exemplary ranges for components of the sprayable composition when provided as a concentrate acidic cleaner, a concentrate highly acidic cleaner, a concentrate neutral quaternary cleaner, a concentrate air freshener, and a concentrate glass window cleaner are provide in Tables 1-6, respectively. Tables 1-6 provided exemplary ranges when the anti-mist component is polyacrylate.

**Table 1-** Concentrate Acidic Cleaner Composition

| Component            | Exemplary Range (wt%) Polyacrylate |
|----------------------|------------------------------------|
| Water                | 45-75                              |
| Acid                 | 7-35                               |
| Solvent              | 3-15                               |
| Non-ionic surfactant | 1-5                                |
| Cationic surfactant  | 0.5-5                              |
| Fragrance & dye      | 0.005-0.3                          |
| Anti-mist component  | 0.5-20                             |
| Stability component  | 0-10                               |

**[0067]** The concentrate acidic cleaner composition of Table 1 can be diluted with water to 5%-15% concentrate to form a use solution. Suitable acid concentrations in the use solution include between 0.1% and 10% by weight of the use solution.

**Table 2 -** Concentrate Highly Acidic Cleaner Composition I

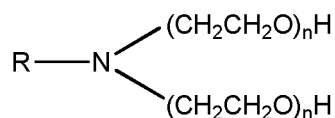
| Component           | Exemplary Range (wt%) Polyacrylate |
|---------------------|------------------------------------|
| Water               | 25-50                              |
| Acid                | 10-75                              |
| Surfactant          | 1.3-10                             |
| Anti-mist component | 0.5-20                             |
| Stability component | 0-10                               |

**[0068]** The concentrate highly acidic cleaner composition of Table 2 can be diluted with water to 5%-15% concentrate to form a use solution. Suitable acid concentrations in the use solution include between 0.1% and 10% by weight of the use solution.

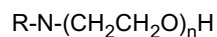
**Table 3 -** Concentrate Highly Acidic Cleaner Composition II

| Component                                        | Exemplary Range (wt%) Polyacrylate |
|--------------------------------------------------|------------------------------------|
| Acid, including a fatty acid antimicrobial agent | 7-45                               |
| Nonionic surfactant                              | 0.1-30                             |
| Anti-mist component                              | 0.5-20                             |
| Stability component                              | 0-10                               |

**[0069]** Suitable nonionic surfactants can be branched or unbranched ethoxylated amine according to one of the following formulas:



or



R can be a straight or branched alkyl or alkylaryl substituent. R can be a substituent having from 1 to 24 carbon atoms and each n can be from 1 to 20. R can be derived from coconut oil and n can be between 1 to 14, preferably between 6 to 12 and have an HLB from approximately 10 to 14, where HLB represents the empirical expression for the hydrophilic and hydrophobic groups of the surfactant, and the higher the HLB value the more water-soluble the surfactant. In one suitable branched ethoxylated amine the total EO groups (n + n) are preferably between 6 to 12 or 6 to 10. In another suitable ethoxylated amine, R can be capped or terminated with ethylene oxide, propylene oxide, or butylene oxide units. A suitable CAS number for an ethoxylated amine can be 61791-14-8.

**[0070]** The nonionic surfactant may be a medium to short chain carbon group having less than 24 carbon atoms that does not include an alcohol. The ethoxylated amine may also be a cocoamine. Ethoxylated cocoamines are commercially available, for example, under tradenames such as Varonic (Evonik Industries) and Toximul (Stepan Company), including Varonic K-210 and Toximul CA 7.5.

**[0071]** The concentrate highly acid cleaner composition of Table 3 can be diluted with water to form a use solution having an acid concentration, including a fatty acid antimicrobial agent, between 1% and 10% by weight.

**Table 4 - Concentrate Neutral Quaternary Cleaner Composition**

| Component           | Exemplary Range (wt%) Polyacrylate |
|---------------------|------------------------------------|
| Water               | 75-95                              |
| Quaternary compound | 5-30                               |
| Dye                 | 0.002-0.01                         |
| Anti-mist component | 0.5-20                             |
| Stability component | 0-10                               |

**[0072]** The concentrate neutral quaternary cleaner composition of Table 4 can be diluted with water to 0.1%-0.5% concentrate to form a use solution. The use solution of the concentrate neutral quaternary cleaner composition can have a pH between 5 and 11.

**Table 5 - Concentrate Air Freshener Composition**

| Component               | Exemplary Range (wt%) Polyacrylate |
|-------------------------|------------------------------------|
| Water, zeolite softened | 50-90                              |
| Nonionic surfactant     | 1-15                               |
| Microbiocide            | 0-0.1                              |
| Anionic surfactant      | 1-10                               |
| Fragrance & dye         | 0.05-15                            |
| Anti-mist component     | 0.5-20                             |
| Stability component     | 0-10                               |

**[0073]** The concentrate air freshener composition of Table 5 can be diluted with water to 3%-10% concentrate to form a use solution.

**[0074]** The concentrate compositions disclosed above in Tables 1-6 may be further concentrated to further reduce the amount of water required to be transported and stored. In one example, the concentrate compositions of Tables 1-6 are concentrated 2 to 4 times. For example, polyacrylate may be present in an amount of between 0.5% to 30% by weight of the concentrate composition. The stability component may present in concentrations up to 20% by weight or up to 40% by weight of the concentrate composition.

## EXAMPLES

**[0075]** The present invention is more particularly described in the following examples that are intended as illustrations only, since numerous modifications and variations within the scope of the present invention will be apparent to those of skill in the art. Unless otherwise noted, all parts, percentages, and ratios reported in the following examples are on a weight basis, and all reagents used in the examples were obtained or are available from the chemical suppliers described

below or may be synthesized by conventional techniques.

#### Materials Used

#### [0076]

Acusol™ 460N: a sodium polycarboxylate (25% active) available available from Dow Chemical, Midland, MI  
 Ammonium Hydroxide available from HVC Cincinnati, OH  
 Aquatreat® AR-7-H: a 1.2 million molecular weight polyacrylate polymer (10%-30% active) available from Akzo Nobel  
 Dissolvine®GL-38: a glutamic acid, N,N-diacetic acid, tetra sodium salt available from Akzo Nobel  
 Dissolvine®GL-47-S: a tetrasodium glutamate diacetate available from Akzo Nobel  
 Glucopon® 215 UP: an aqueous solution of alkyl polyglycosides based on a natural fatty alcohol C8-C10 available from BASF Corporation, Florham Park, NJ  
 Glucopon® 425N: an alkyl polyglycoside surfactant available from BASF Corporation, Florham Park, NJ  
 Irganox® 1135: a liquid hindered phenolic antioxidant available from Ciba Specialty Chemicals  
 Irganox® 5057: a liquid aromatic amine antioxidant available from Ciba Specialty Chemicals  
 KF 1955: a fragrance available from Klabin Fragrances, Cedar Grove, NJ  
 Liquitint® patent blue: a colourant available from Albright & Wilson, Australia  
 Oasis® 146: a neutral quaternary cleaner containing at use dilution 0.036% quaternary ammonium compound and available from Ecolab, St. Paul, MN  
 Oasis® 285: an air freshener solution having a neutral pH and available from Ecolab, St. Paul, MN  
 Oasis® 299: an acidic liquid cleaner and disinfectant available from Ecolab, St. Paul, MN  
 Pluronic® N-3: an ethylene oxide and propylene oxide based block copolymer available from BASF Corporation, Florham Park, NJ  
 Polyox™ WSR 301: a non-ionic polyethylene oxide having a molecular weight of 4,000,00 and available from Dow Chemical, Midland, MI  
 Tinogard® NOA: an antioxidant available from BASF  
 Trilon® M: an aqueous solution of the trisodium salt of methylglycinediacetic acid (Na3MGDA) available from BASF Corporation, Florham Park, NJ  
 Zemea®: Propanediol available from DuPont Tate & Lyle BioProducts  
 Window Cleaner A concentrate: formulated according to Table A  
 Lemon-Lift®: a ready to use alkaline bleach detergent available from Ecolab, St. Paul, MN

#### Example 5 - Polyacrylate Test

Samples 95-98

[0077] The purpose of this experiment was to evaluate the effectiveness of polyacrylate as an anti-mist component. Aquatreat AR-7-H was added to water according to Table 16 to form use solutions which were sprayed using a stock trigger sprayer.

Table 16

|                                   | Sample 95 | Sample 96 | Sample 97 | Sample 98 |
|-----------------------------------|-----------|-----------|-----------|-----------|
| Aquatreat AR-7-H, 20% active, wt% | 2.5%      | 0.5%      | 0.25%     | 0.05%     |
| Water, wt%                        | 97.5%     | 99.5%     | 99.75%    | 99.95%    |
| % active polyacrylate             | 0.5%      | 0.1%      | 0.05%     | 0.01%     |

[0078] All use solutions had a viscosity comparable to that of water (based on visual observation) and homogenized in 1 minute or less to form a clear, colorless solution. Reduced misting was visually observed for Sample 95.

Sample 99

[0079] Sample 99 was a concentrate composition formed by mixing 25 grams Aquatreat AR-7-H with 75 grams water to form a 4% active polyacrylate concentrate. Sample 99 had a viscosity comparable to that of water (based on visual observation), and was a clear, colorless solution.

**Example 6 -Distance Test**

Samples 100-102 and Comparative Sample J

**[0080]** Tests were conducted to investigate the effect of Polyox on the average flight distance of a use solution when dispensed with a stock trigger sprayer using Diazo paper by Dietzgen, which turns blue when exposed to ammonia.

**[0081]** First, water and Polyox concentrations were formed according to Table 17 below. Ammonium Hydroxide in an amount of 2.5% by weight was also added to each Sample. The solutions were added to stock trigger sprayers.

**[0082]** Next, Diazo paper was arranged along a horizontal surface and the stock trigger sprayer was placed at one end of the paper so that when dispensed the horizontal flight distance of the Sample was parallel with the length of the paper. The solution was dispensed by squeezing the trigger sprayer. Because the Samples included ammonia, the paper turned blue when it was contacted by the Sample and the horizontal flight distance of each droplet was visible. The droplet having the further horizontal flight distance was determined and measured. The test was repeated two additional times and the furthest horizontal flight distance of each trial was averaged. The results are presented in Table 17.

**Table 17**

| Sample  | Polyox WSR 301 (ppm) | Flight distance (inch) | % increase vs. Comp. J |
|---------|----------------------|------------------------|------------------------|
| 100     | 20                   | 78.3                   | 17.39                  |
| 101     | 40                   | 88.3                   | 32.38                  |
| 102     | 60                   | 112.4                  | 68.5                   |
| Comp. J | 0                    | 66.7                   | n/a                    |

**[0083]** As shown in Table 17, Polyox increased the flight distance of the Samples compared to Comparative Sample J, which did not include Polyox.

**Claims**

1. A method of forming a sprayable use solution, the method comprising: mixing water with a concentrate aqueous composition to create the use solution, the concentrate aqueous composition comprising: at least one surfactant; and a polyacrylate which reduces atomization and misting when the use solution is dispensed using a sprayer, wherein the concentrate aqueous composition is mixed with sufficient water to form a use solution having between about 0.2% and about 5% by weight polyacrylate.
2. The method of claim 1, wherein the concentrate aqueous composition further comprising at least one stability component selected from the group consisting of antioxidants, chelants, and solvents.
3. The method of claim 1, wherein the concentrate aqueous composition further includes between about 0.01% and about 10.0% by weight propylene glycol.
4. The method of claim 1, wherein concentrate aqueous composition includes at least one acid and the use solution has a pH of about 4.5 or less.
5. The method of claim 1, wherein the acid includes a fatty acid selected from the group consisting of: hexanoic acid, butyric acid, octanoic acid, heptanoic acid, nonanoic acid, decanoic acid, undecanoic acid, and dodecanoic acid.
6. The method of claim 1, wherein the surfactant includes a quaternary ammonium compound.
7. The method of claim 1, wherein the surfactant includes at least one nonionic surfactant and at least one anionic surfactant

**Patentansprüche**

1. Verfahren zum Bilden einer sprühbaren Gebrauchslösung, das Verfahren Folgendes umfassend:

Mischen von Wasser mit einer konzentrierten wässrigen Zusammensetzung, um die Gebrauchslösung zu erzeugen, die konzentrierte wässrige Zusammensetzung Folgendes umfassend:

- mindestens ein Tensid; und  
ein Polyacrylat, das die Zerstäubung und das Beschlagen reduziert, wenn die Gebrauchslösung unter Einsatz eines Sprüher abgegeben wird, wobei die konzentrierte wässrige Zusammensetzung mit ausreichend Wasser gemischt wird, um eine Gebrauchslösung mit zwischen etwa 0,2 Gew.-% und etwa 5 Gew.-% Polyacrylat zu bilden.
2. Verfahren nach Anspruch 1, wobei die konzentrierte wässrige Zusammensetzung ferner Folgendes umfasst: mindestens eine Stabilitätskomponente, die aus der Gruppe ausgewählt ist, die aus Antioxidantien, Chelatoren und Lösungsmitteln besteht.
3. Verfahren nach Anspruch 1, wobei die konzentrierte wässrige Zusammensetzung ferner zwischen etwa 0,01 Gew.-% und etwa 10,0 Gew.-% Propylenglykol beinhaltet.
4. Verfahren nach Anspruch 1, wobei die konzentrierte wässrige Zusammensetzung mindestens eine Säure beinhaltet und die Gebrauchslösung einen pH-Wert von etwa 4,5 oder weniger aufweist.
5. Verfahren nach Anspruch 1, wobei die Säure eine Fettsäure beinhaltet, ausgewählt aus der Gruppe bestehend aus: Hexansäure, Buttersäure, Octansäure, Heptansäure, Nonansäure, Decansäure, Undecansäure und Dodekansäure.
6. Verfahren nach Anspruch 1, wobei das Tensid eine quaternäre Ammoniumverbindung beinhaltet.
7. Verfahren nach Anspruch 1, wobei das Tensid mindestens ein nichtionisches Tensid und mindestens ein anionisches Tensid beinhaltet.

## Revendications

1. Procédé de formation d'une solution d'utilisation pulvérisable, le procédé consistant à :  
mélanger de l'eau avec une composition aqueuse concentrée pour créer la solution d'utilisation, la composition aqueuse concentrée comprenant :  
au moins un tensioactif ; et  
un polyacrylate qui réduit l'atomisation et la brumisation lorsque la solution d'utilisation est distribuée à l'aide d'un pulvérisateur, dans lequel la composition aqueuse concentrée est mélangée avec suffisamment d'eau pour former une solution d'utilisation contenant entre environ 0,2 % et environ 5 % de polyacrylate.
2. Procédé selon la revendication 1, dans lequel la composition aqueuse concentrée comprend en outre au moins un composant stabilisant choisi dans le groupe constitué des antioxydants, des chélateurs et des solvants.
3. Procédé selon la revendication 1, dans lequel la composition aqueuse concentrée comprend en outre entre environ 0,01 % et environ 10,0 % de propylène glycol.
4. Procédé selon la revendication 1, dans lequel la composition aqueuse concentrée comprend au moins un acide et la solution d'utilisation a un pH d'environ 4,5 ou moins.
5. Procédé selon la revendication 1, dans lequel l'acide comprend un acide gras choisi dans le groupe constitué des éléments suivants :  
l'acide hexanoïque, l'acide butyrique, l'acide octanoïque, l'acide heptanoïque, l'acide nonanoïque, l'acide décanoïque, l'acide undécanoïque et l'acide dodécanoïque.
6. Procédé selon la revendication 1, dans lequel le tensioactif comprend un composé d'ammonium quaternaire.
7. Procédé selon la revendication 1, dans lequel le tensioactif comprend au moins un tensioactif non ionique et au moins un tensioactif anionique.

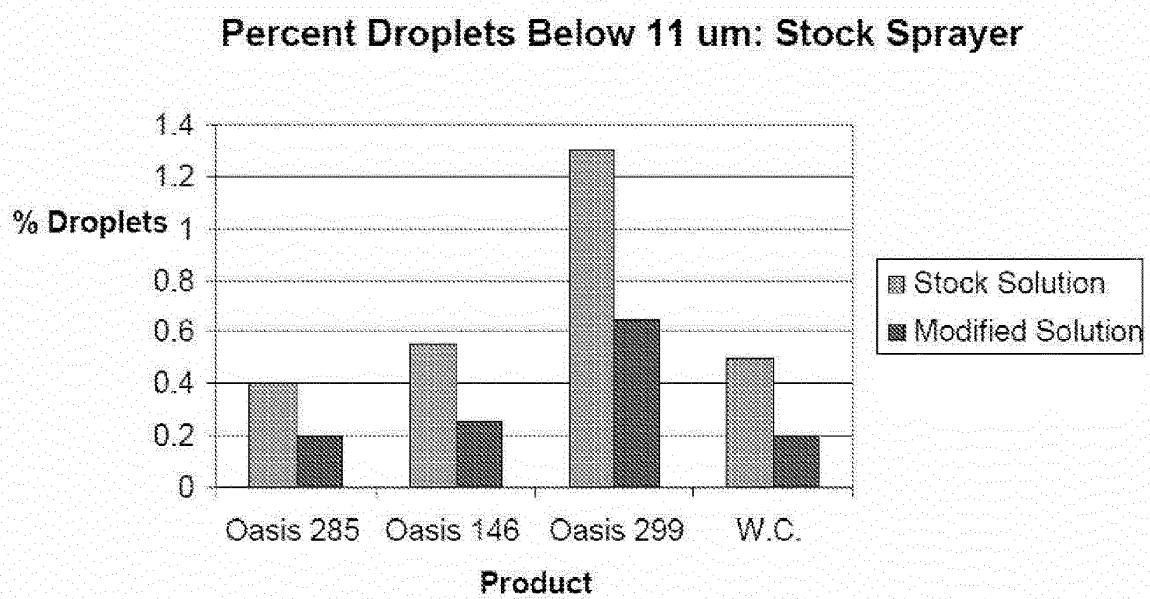
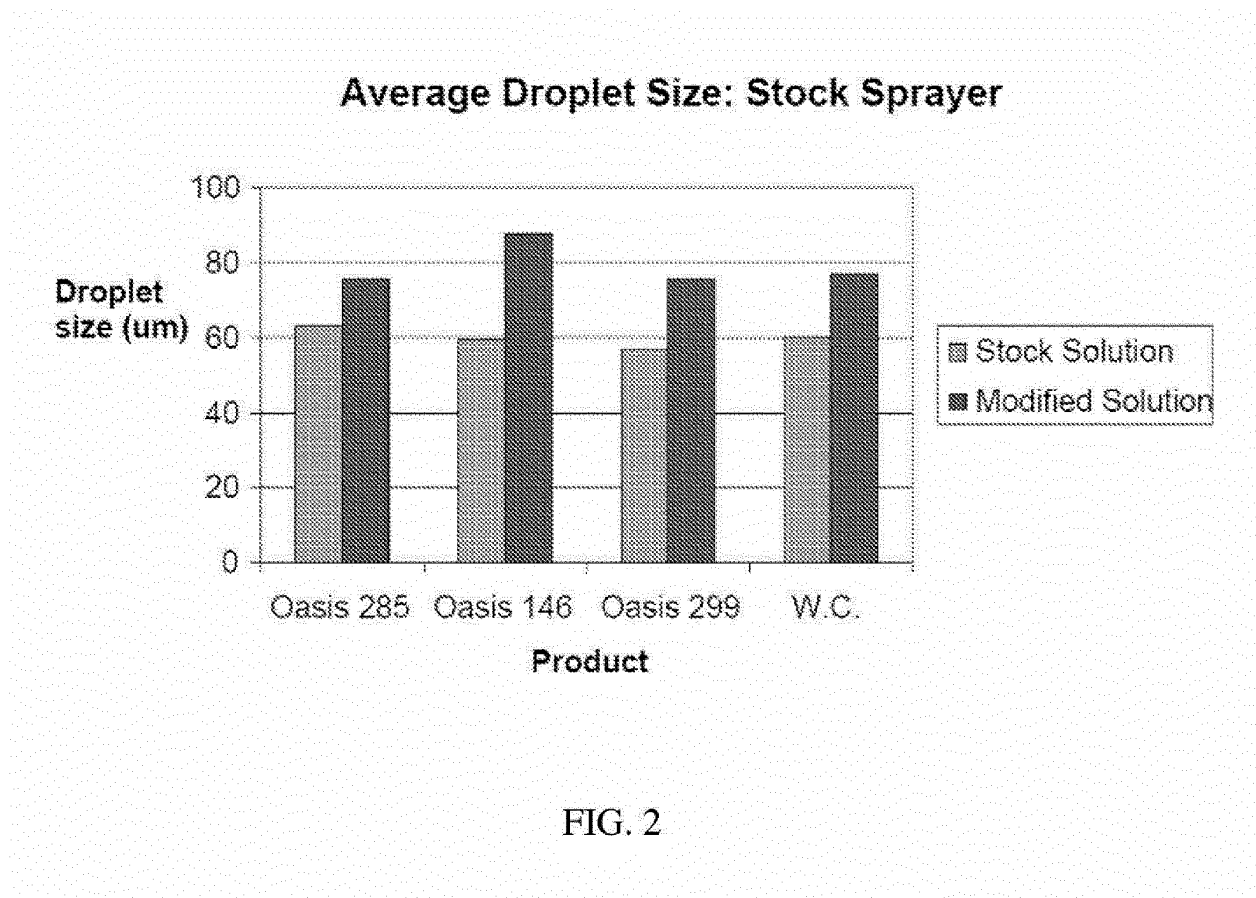
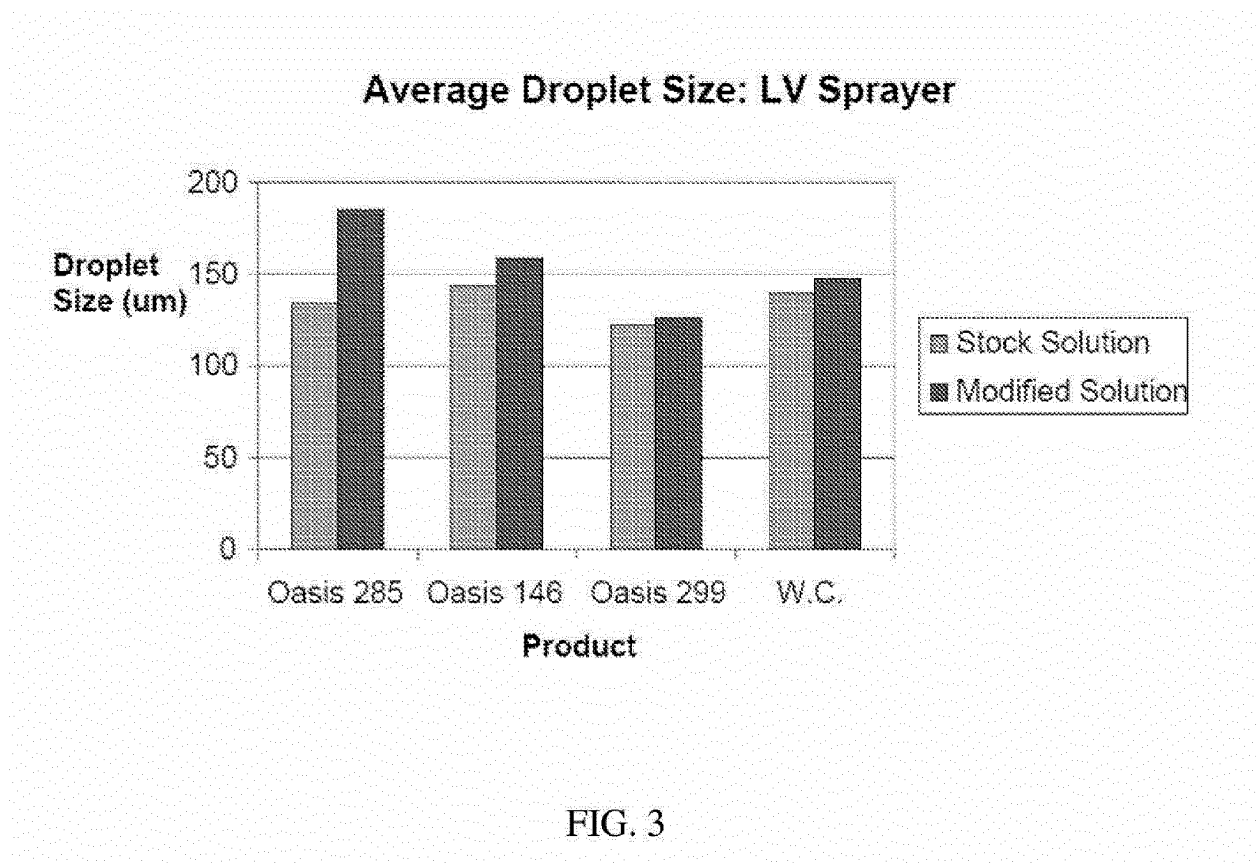


FIG. 1





## REFERENCES CITED IN THE DESCRIPTION

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